Early warning of actual and potential cyanotoxin production

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Introduction

The cyanobacteria which develop into mass populations in aquatic environments commonly include species and strains which produce potent toxins, alongside phylogenetically- or phenotypically similar strains which do not. The diverse range of low molecular weight cyanotoxins which can be produced present health hazards ranging from severe to mild in potable and recreational water resources.

Hypothesis

Risk management of these problems is aided if it is known whether the organisms present have the potential to produce cyanotoxins and whether they actually do so.

Methods

Understanding of the production and abundance of the toxins themselves is being advanced through the use of physicochemical and antibody methods. PCR is finding increasing application for the detection and quantification of cyanotoxin genes, whilst fluorescent *in situ* hybridisation (FISH) is amenable for the localisation of cyanotoxin genes in mixed phytoplankton populations.

Results

Using such methods as an early warning system, we are quantifying microcystins in single filaments and single colonies of cyanobacteria using antibody-based procedures (CQ-ELISA) and measuring the genetic potential for microcystin and cylindrospermopsin production in single filaments and colonies through the use of PCR and FISH. Detection of DNA sequences for cyanotoxin peptide synthetases and polyketide synthases is thereby feasible in *Microcystis*, *Planktothrix*, *Anabaena*, *Nostoc*, *Nodularia*, *Aphanizomenon* and *Cylindrospermopsis*. Some examples are given for the United Kingdom.

Discussion

For these methods to be integrated into effective early warning systems, it is necessary that good systems are also developed for the collection and delivery of samples for analysis and for the rapid reporting of results. For early warning of potential or actual cyanotoxin production to be useful in cyanotoxin risk management, it is also necessary that data interpretation is available and that contingency measures by water utility managers and operatives are already in place.

Conclusion.

Early warning of actual or potential cyanotoxin production is possible using a range of methods. Rapid sample processing times in a prepared laboratory can enable results to be obtained within as little as 1-3 hours, and typically on the day of sample receipt.